

person undergoing a terrifying experience is to turn to the parent for guidance and reassurance. The anesthetist assumes this rôle, and if his personality is such that it fits in with the patient's previous psychic fixations, his power is greatly augmented. For example: A father-fixated woman usually finds it much easier to place her confidence in a middle-aged, fatherly appearing male, and frequently has difficulty in adjusting to a young woman. The physical and personality traits of the child's mother must be considered in choosing the anesthetist of an adolescent or younger child. In this connection we must not forget that the feminine protest so common in middle-aged American men would be more easily handled by a male.

Another point of great value is the care with which the operating team and nursing staff must guard their chance remarks during the critical periods of the induction of anesthesia, and just preceding the regaining of full consciousness. Unguarded remarks at these times reach the patient in a mood extremely favorable for suggestion, and the ill effects of unfavorable suggestion may not be evident for some weeks. The psychic difficulties engendered are often not seen by the surgeon, and their causes are only uncovered by painstaking and costly psychic investigation. There is a very fertile field for favorable psychic suggestion during the preanesthetic stage of anesthesia, especially if this be prolonged by preoperative sedation. If the extremely favorable psychic state a patient can be thrown into by kindly and hopeful suggestion at this stage were generally appreciated, fewer psychic complications would be encountered during convalescence. I hope that at a future date the many factors just touched upon by the authors will be further elaborated, for I am sure that when these factors are considered, the art of anesthesia will progress in ways as yet impossible by the pharmacologic approach.

MIXTURE OF NOVOCAIN AND NUPERCAIN IN INTRADURAL BLOCK (SPINAL) ANESTHESIA*

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DISCUSSION by Edmund Butler, M. D., San Francisco;
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EXPERIMENTAL work which has been confirmed from different sources has shown that blood-pressure fall after the administration of spinal anesthesia is not due to splanchnic dilation, but is mainly cardiac. Paralysis of the intercostal and phrenic nerves interferes with normal chest expansion and diaphragmatic excursion, causing stasis of blood in the right heart and its tributaries. The proper use of ephedrin is an important preventive measure against excessive fall in blood pressure. Early recognition of too high anesthesia (loss of epicritic and protopathic sensation above the level of the sixth rib) and immediate institution of proper carbon dioxid and oxygen therapy prevents serious complications. Proper selection of cases so as to exclude those presenting advanced degenerative changes in the cardiovascular system is a most important precaution. The poor risk patient, due to degenerative changes in any vital organ, especially those with myocardial degeneration with or without hypertension, represents the principal contraindication to this anesthetic. Cases of hypotension *per se* are not bad

risks, but, on the contrary, do exceptionally well under spinal anesthesia. Traumatic and hemorrhagic shock remains definitely a contraindication.

DOSAGE IN SPINAL ANESTHESIA

It is a known fact that a certain minimum dosage of any of the common agents in use for spinal anesthesia is sufficient to produce adequate anesthesia, the height depending primarily on the amount of spinal fluid removed and reinjected. Contrary to the published belief of many, increase in dosage does not materially affect the height or duration of the anesthetic, but definitely increases the hazard of uncontrollable complications.

Similarly prepared solutions of specific gravities different from that of spinal fluid are used, supposedly to control height and length of anesthesia. I have never been able to duplicate the results claimed for these solutions, and I feel that they possess no advantages over the novocain crystals dissolved in spinal fluid. Anesthesia of forty-five minutes to one hour duration may be expected with the use of novocain. This not infrequently requires some supplemental inhalation anesthesia toward the close of the operative procedure, often deep anesthesia to close the peritoneum in laparotomies. This always causes delay, but more particularly added shock, which is a distinct hazard for the patient.

NUPERCAIN

With the idea of overcoming this hazard by the use of novocain, I previously observed a series of cases¹ in which nupercain was administered. (Nupercain or percain has been satisfactorily reported as producing prolonged anesthesia in the dosage of two cubic centimeters of a 1:200 solution in physiological saline. In this great dilution its effects are nontoxic.) An analysis of the series in which nupercain was administered, as compared with a previous series² given, novocain crystals yielded the following conclusions:

1. Nupercain is a safe and satisfactory agent for spinal anesthesia when used for operations below the diaphragm.

2. It has the following disadvantages as compared with procain crystals: (a) Lengthened period of onset of anesthesia following administration. (b) Definitely greater tendency to post-anesthetic headache.

3. It has the following advantages as compared with procain crystals: less variation in individual susceptibility to the drug; less nausea, vomiting, and subjective symptoms because of the better sustained blood-pressure level; less blood-pressure fall and more constant level after the initial drop; sufficient length of anesthesia with the average nontoxic dose for all operative procedures, the markedly lengthened analgesia promoting greater immediate postoperative comfort for the patient.

With the above information at hand I became interested in learning if a suitable combination of novocain and nupercain could be effected so as to derive the major advantages from both and perhaps by such a combination do away with some of the disadvantages of each.

* A preliminary report. Submitted January 6, 1933.

TECHNIQUE OF ADMINISTRATION

In a patient properly prepared for spinal anesthesia, *i. e.*, proper sedation before coming to the operating room, with the administration of 50 milligrams of ephedrin in lower abdominal cases and 100 milligrams in upper abdominal cases fifteen minutes before lumbar puncture, the lumbar tap is made with a fine-gauge needle in the second or third lumbar space. Details of the proper posture of the patient in the lateral position to facilitate an accurate spinal tap are adhered to as outlined by Huff.³

Fifty milligrams of novocain crystals are dissolved in two cubic centimeters of 1:200 nupercain solution. A ten cubic centimeter syringe containing this mixture is attached to the spinal needle and a sufficient quantity of spinal fluid aspirated to obtain the desired height of anesthesia after the well-known volume control technique.

Following administration the patient is placed in a moderate Trendelenburg position, watched and entertained, the height of anesthesia carefully determined, frequent blood pressure determinations made, and toxic symptoms of too high anesthesia or too great blood-pressure fall controlled immediately.

One feature I particularly insist upon is the giving of very light gas anesthesia if the patient is fretful or nervous about being conscious of his surroundings. This comforts the nervous type of patient and in no way complicates the anesthesia. In fact the giving of a proper amount of oxygen is provided, and the surgeon has the advantages of the regional anesthesia for his work. I think it is wrong to insist on consciousness in these patients. If awake the patient should not be narcotized to the extent that he is unable to cooperate in the necessary breathing exercises.

Following operation, the patient is kept flat in bed for twenty-four hours to minimize the possibility of postanesthetic headache. The postoperative advantages to the patient administered spinal anesthesia are known and need no reiteration.

ANALYSIS OF RESULTS

This study comprises seventy-four cases personally anesthetized and operated, representing surgical procedures on the stomach, colon, and biliary tract in the upper abdomen, hernia, appendix, prostate and female generative organs, many combined abdominal and perineal operations in the lower abdomen.

Of the seventy-four cases, forty-four, or 59 per cent, showed an average fall of systolic blood pressure of 20.4 millimeters; fourteen cases, or 18 per cent, were stabilized without fall or elevation; while sixteen, or 21 per cent, showed an average elevation of blood pressure from the pre-anesthetic level of 23.6 millimeters.

In the series given nupercain alone, the average fall of systolic blood pressure was 17.3 millimeters. This corresponds almost exactly with Keyes'⁴ figure of 18 millimeters for his series, which he compares with a series of cases given novocain crystals in which there was an average drop of

31 millimeters, and a further drop of 39 millimeters in another group administered spinocain. It is evident, therefore, that the addition of 50 milligrams of novocain to the average dose of nupercain does not materially alter the average blood-pressure fall. Furthermore, careful graphic records demonstrated that the typical nupercain curve still predominated, *i. e.*, an immediate but diminished fall in blood pressure with a constant maintenance of the low level until the blood pressure begins gradually to return to normal. With the use of novocain and spinocain original blood-pressure fall is more gradual, the lowest point being reached in about one-half hour, with further subsequent drops not uncommon. Thus with the typical nupercain reaction, as compared with novocain, late reactions in the form of nausea and vomiting due to delayed fall in blood pressure need not be expected to disturb the operative procedure.

Failure to obtain anesthesia did not occur with the novocain-nupercain mixture. Furthermore, almost immediate anesthesia was obtained as with the use of novocain alone, obviating the delay of ten to fifteen minutes experienced when nupercain was the sole agent. No change was noted in the average duration of nupercain anesthesia, the period being from three to five hours, with partial anesthesia for a much longer time. The feature of lengthened analgesia contributes in no small way to the comfort of the patient in the immediate postoperative period, especially if morphin and sodium amytal are given before the anesthetic effect of the nupercain is allowed to wear off completely.

There were few subjective symptoms during the anesthesia, occasionally slight nausea, notably less than with novocain, as personal susceptibility to nupercain is negligible. Curiously enough, post-anesthetic headache occurred with the novocain-nupercain mixture in only 3 per cent of cases as compared with 6 per cent in the nupercain series, and 1.9 per cent in the group administered novocain crystals. In those instances where headache developed, it was checked immediately by the intravenous use of caffein sodium benzoate, this therapy being apparently a specific for this complication.

CONCLUSIONS

1. Novocain-nupercain mixture in the proportion of 50 milligrams of novocain to two cubic centimeters 1:200 nupercain solution is a safe agent for intradural block anesthesia.

2. In this dosage and combination are derived the major advantages of each agent; these advantages being:

- (a) Lengthened period of anesthesia and analgesia sufficient for all operative procedures characteristic of nupercain.

- (b) Immediate anesthesia as with novocain crystals.

- (c) Less blood-pressure drop with maintenance of a constant level giving fewer subjective symptoms during anesthesia, due to a decrease in individual susceptibility to the effects of nupercain.

(d) A 50 per cent decrease in postanesthetic headache as compared with the use of nupercain alone.

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DISCUSSION*

EDMUND BUTLER, M. D. (490 Post Street, San Francisco).—I have not had sufficient experience with a solution of novocain and nupercain in intradural block to be able to recommend or discourage its use. Doctor Holder's claims are reasonable. The decrease in the fall of blood pressure and the greatly lengthened period of the analgesia are qualities much desired. I am convinced if these qualities prove to be constant over a large series and no serious disadvantages develop, the novocain and nupercain solution will soon be generally used. I feel very definitely the use of intradural block is contraindicated in patients who have any history of myocardial weakness or of coronary sclerosis.

Slightly in disagreement with Doctor Holder, I do not believe that shock is a contraindication to intradural block. If the blood vessels are elastic and the myocardium is normal, the shocked patient is just as safe, in my opinion, under intradural block as under any anesthesia. In gunshot wounds of the abdomen, perforated ulcer and perforated appendicitis with general peritonitis, the operator is able to work much more speedily aided by complete relaxation. Some surgeons have reported a lessened mortality when using subdural block in the above type of cases.

* A letter by A. M. McLellan, M. D., New York, to *The Journal of the American Medical Association*, and published on February 4, 1933, in which the toxicity of nupercain is discussed, is here appended.

To the Editor:—In Queries and Minor Notes (*THE JOURNAL*, December 3, 1932, p. 1973) occurs a caution regarding the toxicity of nupercain which may lead to misunderstanding.

One should distinguish between absolute and relative toxicity. True, nupercain is, absolutely, fully equal to cocaine in toxicity as judged by subcutaneous injection into dogs. On the other hand, it has been shown to be more powerfully anesthetic, so that its relative toxicity may eventually be found to be less than that of cocaine by injection. Indeed, so far as I am aware, there is no proof that nupercain, in proper anesthetic concentration, is more toxic than procain in similar anesthetic strength. Unfortunately, through carelessness or ignorance, nupercain has been used in some instances in far greater concentration than is necessary or advised, and the disastrous results have been ascribed unjustly to the drug and not to its user.

My associates and I have been using nupercain now over three years for surface, infiltration, caudal and subarachnoid anesthesia. In the urethra we employ 1:250 solution, injecting a total of about 20 cubic centimeters in the anterior and posterior urethra. This procedure has been followed in approximately one thousand patients and we have yet to observe an instance of toxic reaction. There is no doubt in my mind that the injection of 1:250 solution of nupercain into the urethra may cause poisoning if it is done with carelessness; likewise, there is no doubt in my mind that the intra-urethral injection of 4 per cent procain hydrochlorid may cause serious or even fatal reaction if it is done soon after instrumentation, or if undue force is used in making the injection.

In my opinion, there is no "fool-proof" local anesthetic that is truly effective, and one cannot too strongly condemn exaggerated claims regarding the safety of these drugs. On the other hand, from personal experience and a fair knowledge of the literature, I do not believe that the risk attending the intelligent use of nupercain for any type of anesthesia is greater than that attending the employment of the "safe" procain hydrochlorid.—A. M. McLellan.

I still feel when operating upon patients, where the past history is not clear and the anesthetist is not expert, ether by the drop method is the safest anesthetic.

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W. W. CROSS, M. D. (1624 Franklin Street, Oakland).—To one who has observed spinal anesthesia since it was introduced in surgical procedures, the progress that has been made is as impressive as the procedures when first introduced. Calling to mind experience with cocain, stovain, tropacocain, and novocain, which are apparently toxic, in the order named and have been discarded in this order save the last, which would have, had it not been for the introduction of ephedrin.

Should the contention set forth by Doctor Holder be the experience of others who are influenced by his suggestions, it would mean further improvement in this valuable method of inducing anesthesia.

During the past eight years, in association with Dr. L. L. Stanley in the state prison at San Quentin, an opportunity has been afforded to observe the records of four thousand spinal anesthetics. This has embraced the use of several different drugs, but many years ago novocain was found satisfactory. There have been many efforts to induce a change, but we adhere to the novocain crystals dissolved in two centimeters of spinal fluid. Since ephedrin was added to the procedure the results have been better. This is usually given by mouth, three-fourths of a grain one-half hour before the patient goes to the operating room.

While there have been many suggestions as to the contraindications in certain conditions, our experience has not made such facts sufficiently marked to observe them.

My own work is confined to urologic surgery, and many are men, old and feeble, with cardiac and vascular disease practically a certainty, but there has not been a death. The only death we felt we could charge to the anesthesia was in a young man who had peptic ulcer with perforation and hemorrhage. A spinal was administered to facilitate the effort to deal with the hemorrhage. He was exsanguinated when he reached the hospital.

In high operations the second space is used, and for a nephrectomy the patient remains on the side to be operated upon for five minutes. One observes the effect is confined largely to that side until the patient is turned to the other side.

The usual dose ranges from 50 to 150 milligrams. The anesthesia lasts usually for one hour. In my private work, gas and oxygen are frequently added for the comfort in relieving the nervous tension of the patient, but previous medication is seldom given.

Certainly in urological procedures that are carried out upon old men with poor kidney function and cardiac and vascular disease, spinal anesthesia has added much to enable such patients to be brought through a serious surgical procedure successfully.

Although not having had experience with nupercain alone or a combination with novocain, one cannot be otherwise than impressed that it has merit, as the experience of Doctor Holder indicates and for the reasons he has set forth.

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DOCTOR HOLDER (Closing).—I wish to thank Doctors Butler and Cross for their discussion. Finally, I would mention recent experience with this combination in connection with pantocain. Experiencing very definite delay with the onset of complete anesthesia when using pantocain, I have satisfactorily employed a similar technique with this agent. Length of anesthesia is approximately one-half that of nupercain, but with less reaction. My experience has been prompt anesthesia as with novocain alone, when using the above mixture; with much lengthening of anesthesia with both these substances when lengthened anesthesia is desired.